Interface Control Document (ICD)
Between the
Image Assessment System (IAS)
and the
Landsat 7 Processing System (LPS)

January 31, 1996

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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List of TBDs/TBRs

Section	Description
1.4	IAS host processor is not known.
	Details on the EDC LAN are unknown.
2.2.1	Document number for the Landsat 7 Calibration Parameters - Definition and Formats document is unknown.
2.2.6	Document No. for the IAS Operations Concept document is unknown.
3.2.1.e	FIRST_ORBIT_START_TIME may not be available from IAS. In LPS baseline design. Investigating its need by LPS or other Landsat 7 systems.
3.2.1.j	RADIOMETRIC_CAL_COEFFICIENTS - ACCA_NOMINAL_OFFSETS **(TBR)** - IAS Project specified TBR.
3.2.1.k	TIME_COEFFICIENTS (**TBR**) - Requires review by IAS Project.
3.2.8	Details on the EDC LAN are unknown.
3.2.9	The IAS parameters file size/volume is a preliminary estimate.
Table 3-2	The LPS host/operations console names, IP addresses are unknown.
	Details on the network routers used at EDC are unknown.
	The IAS host names and IP addresses are unknown.
3.3.5	EDC to concur that standard operating procedures (SOPs) will be used for submitting, receiving, logging and servicing reprocessing requests.
3.4.5	EDC to concur that standard operating procedures (SOPs) will be used for providing, receiving and logging dispositions of reprocessing requests.
3.4.8.3	EDC to concur that standard operating procedures (SOPs) will be used to provide written dispositions for reprocessing requests (back-up for voice/telephone medium).

CHANGE STATUS LOG

DOCUMENT NO. 514-1ICD/0195

TITLE Interface Control Document (ICD) Between the Image Assessment System (IAS) and the Landsat 7 Processing System (LPS)

CHANGE	DATE	AFFECTED PAGES	REMARKS
Review	3 November 1995	ALL	Review
Signature	31 January 1996	ALL	Signature

Abstract

This Interface Control Document (ICD) presents the functional, performance, operational, and design requirements for the interface between the (Landsat 7) Image Assessment System (IAS) and the Landsat 7 Processing System (LPS) .

This document provides a current understanding of the definition of the information and products transferred between the IAS and the LPS. This interface control document will be baselined by the IAS and LPS Projects for developing and implementing the interface between the IAS and the LPS.

Keywords: Interface Control Document (ICD)
Image Assessment System (IAS)
Landsat 7 Processing System (LPS)

Preface

The purpose of this interface control document (ICD) is to provide complete information concerning the information and products to be transferred between the Image Assessment System (IAS) and the Landsat 7 Processing System (LPS) in support of the Landsat 7 Ground Segment (GS). The contents in this ICD are complete to a level sufficient to develop and operate the interface; therefore, the document is intended for use only by those directly involved with the mission and/or facilities involved. No attempt has been made to relate this ICD to the total Landsat 7 ground system or to nonpertinent aspects of the facilities/organizations involved.

This ICD is controlled jointly by the Image Assessment System (IAS) Project and the Landsat 7 Processing System Project and may be updated by the Document Change Notice (DCN) and/or revision procedures . Comments and questions regarding this ICD should be directed to:

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Table of Contents

Section 1 — Introduction

Section 2 — Applicable Documents

Section 3. Interface Design

Abbreviations And Acronyms

List of Figures

List of Tables

Section 1 — Introduction

1.1 Purpose

This interface control document (ICD) defines the data transfer interface between the Image Assessment System (IAS) and the Landsat 7 Processing System (LPS) in support of the Landsat 7 Ground Segment. Specific details on the format of the data transferred between the IAS and the LPS are provided in the Landsat 7 Calibration Parameters File - Definition and Formats document (Applicable Document 2.1.1)

1.2 Mission Phases

The following mission phases are pertinent to the IAS-LPS interface:

- Mission Readiness Testing
- In-Orbit Testing
- Normal Mission Operations

These mission phases are defined in Applicable Document 2.2.1.

1.3 Mission-Specific Characteristics

None.

1.4 Facilities/Systems

Figure 1-1 depicts the IAS and LPS Facilities/Systems Flow Diagram representing the facilities/systems committed for supporting the IAS/LPS interface. The following Facilities/Systems are committed:

- EDC Telephone System – supports voice communication of reprocessing requests and reprocessing request disposition information between the IAS and LPS operators.
- **TBD** IAS hosts – support the transmission of IAS calibration parameters file to the LPS operations consoles.
- **TBD** Earth Resources Observation System Data Center (EDC) Ethernet Local Area Network (LAN) – supports the transmission of IAS

calibration parameters from the IAS hosts to the LPS operations consoles.

- LPS Operations Consoles – support the receipt of IAS calibration parameters from the IAS hosts. The LPS operations consoles consist of Silicon Graphics Incorporated (SGI) Indy series workstations.

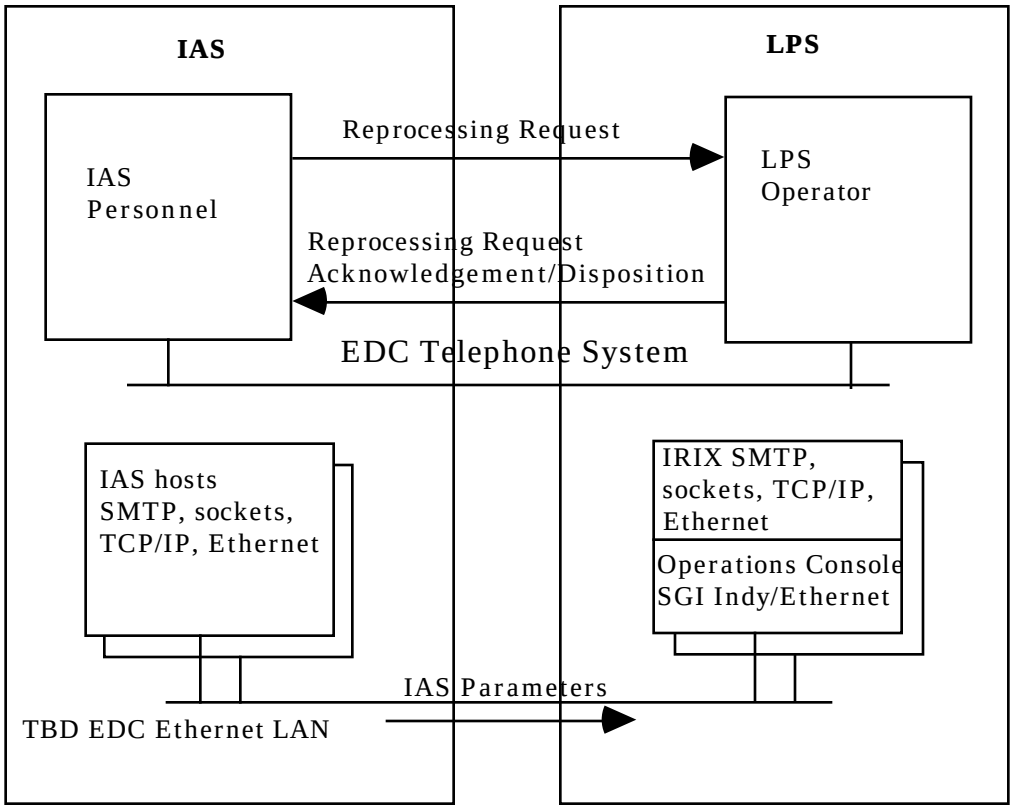

Figure 1-1: IAS-LPS Facilities/Systems Flow Diagram

2 — Applicable Documents

The following documents, of the exact issue date as shown, provide more detailed information regarding the LPS, the IAS, and the Landsat 7 system. If there are conflicts between the listed document and the requirements of this ICD, the requirements of this ICD shall be considered to be the superseding requirements

2.1 Applicable Documents

1. NASA GSFC/MO&DSD, Landsat 7 Calibration Parameters File - Definition and Formats, **Document No. TBD.**

2. NASA GSFC/MO&DSD, Landsat 7 Processing System (LPS) Output Files Data Format Control Book (DFCB), Review, November 3, 1995

3. Computer Sciences Corporation, J2000.0 Coordinate Conversion Software Mathematical Background and System Description, CSC/SD-89/6148, September 1989.

4. Lockheed-Martin Astro Space, Landsat 7 System Program Coordinate System Standard, Revision B, 23007610A, December 2, 1994.

2.2 Reference Documents

These documents are used for background information.

1. National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Landsat 7 Detailed Mission Requirements, May 15, 1995.

2. MO&DSD Mission Operations Concept Document for the Landsat 7 Ground System, June 5, 1995.

3. NASA GSFC/MO&DSD, Landsat 7 Processing System (LPS) Functional and Performance Specification (F&PS), Revision 1, 560-8FPS/0194, July 28,1995.

4. NASA GSFC/MO&DSD, Landsat 7 Image Assessment System (IAS) Element Specification, 430-15-01-001-0.

5. NASA GSFC/MO&DSD, Landsat 7 Processing System (LPS) Operations Concept Revision 1, 560-3OCD/0194, August 25, 1995.

6. NASA GSFC/MO&DSD, Landsat 7 Image Assessment System (IAS) Operations Concept, **Doc. No. TBD**.

7. Lockheed-Martin Astro Space, Landsat 7 System Data Format Control Book (DFCB), Volume 4 - Wideband Data, 23007702, Revision C, September 15, 1995.

8. GSFC/MO&DSD, Systems Management Policy, MDOD-8YMP/0485, July, 1986

Section 3. Interface Design

This section describes all information and products transferred between the IAS and the LPS.

3.1 Product Summary Chart

Table 3-1 summarizes the products and information to be transferred between the IAS and the LPS.

Table 3-1: Interface Product/Information Summary Chart

Product or Information Name ------>	**IAS Calibration Parameter File**	**Re-Processing Request**	**Re-Processing Request Disposition**
From - To Orgn.	IAS - LPS	IAS - LPS	LPS - IAS
ICD Section	3.2	3.3	3.4
Description / Purpose	Supplies Landsat processing parameters	Requests reprocessing of a Landsat 7 contact period	Advises IAS on the disposition of a reprocessing request
Mission Phase	All	All	All
Accuracy/ Completeness	Each version of the file contains complete set of parameters	Includes Contact period identification (from LPS Metadata)	Includes Contact period identification (from reprocessing request) and disposition
Delivery Schedule	As required, (Nominal 3 months)	As required, Approximately one per day	As required
Time Span	From effective date till replaced by IAS with a new one (Nominal 3 months)	Not Applicable	Not Applicable
Transmission Medium/Protocol	File Transfer Protocol (FTP)	Voice / Paper	Voice /Paper
Volume Estimate	1 MB (includes 100% overhead to IAS estimate)	Not Applicable	Not Applicable
Security Exception	None	None	None

The following sections provide more detail on the characteristics of each interface product or information item.

3.2 IAS Calibration Parameters File

3.2.1 Description

The IAS Calibration Parameters File specifies calibration, radiometric correction, and geometric correction values to be used in processing Landsat 7 data. LPS receives the complete IAS Calibration Parameters File but uses only the components of the IAS Calibration Parameters File listed in LPS Level 0R processing operations. Complete details on each component of the IAS Calibration Parameter File are contained in Applicable Document 2.2.1 (Landsat 7 Calibration Parameters File - Definition and Formats). The IAS calibration parameters names, as called out in the Landsat 7 Calibration Parameters File - Definition and Formats, are shown in parenthesis [ ]. If an IAS calibration parameters name is not known, its is indicated by a [**TBS**].

a. IAS_PARAMETERS_FILE_VERSION_NUMBER – An integer identifier unique for each version of the IAS calibration parameters file. [Version Number]

b. IAS_PARAMETERS_EFFECTIVE_DATE -- The Julian Date the IAS calibration parameters are operationally used by Landsat 7 systems (IAS, LPS and LP DAAC) for producing and distributing the Level 0R products. This date is at a minimum of 7 days past the date of IAS notification provided to the LPS and LP DAAC. [Effective Date]

c. SENSOR_ALIGNMENTS – Integer pixel shifts for each detector of each ETM+ band. Integer shifts for both the forward and reverse scans are provided by IAS. (A total of 136 values for each scan direction are provided). [DETECTOR ADJUSTMENTS]

d. NOMINAL_ORBIT_PERIOD – The duration (in seconds) of a Landsat 7 orbit (required by LPS for calculating the Landsat 7 orbit number). [Orbit Period]

e. FIRST_ORBIT_START_TIME **(TBR)** – The UTC time of the start of the first orbit (required by LPS for calculating the Landsat 7 orbit number). [**TBR**]

f. SEMI_MAJOR_AXIS – Earth semi-major axis length (required for WRS scene determination by LPS). [Radius of Earth at Equator]

g. SEMI_MINOR_AXIS – Earth semi-minor axis length (required by LPS for WRS scene determination). [Radius of Earth at Pole]

h. ETM_TO_SC_BODY – The transformation matrix from ETM+ line of sight at center of mirror scan to spacecraft body coordinates (required by LPS for WRS scene determination). [Attitude Control Reference Axes to ETM+ Optical Axis]

i. RADIOMETRIC_CAL_COEFFICIENTS_GAINS - Nominal Gains to be applied by LPS to Level 0 data before performing cloud cover assessment. A set of 4 values of gains (highs and lows for forward and reverse directions) are provided for each detector of each band for the ETM+ instrument.

j. RADIOMETRIC_CAL_COEFFICIENTS_ACCA_NOMINAL_OFFSETS **(TBR)** - Nominal offsets to be applied by LPS to Level 0 data before performing cloud cover assessment. A set of 4 values of offsets (for high and low gains in forward and reverse directions) are provided for each detector of each band for the ETM+ instrument.

k. TIME_COEFFICIENTS **(TBR)** - The Time Coefficient data, obtained by IAS from the internet, consists of differences between the UT1 and UTC times over a span of next 20 years (from the last update date). The LPS needs these time coefficients to calculate the Greenwich Hour Angles (GHA) for meeting the WRS scene determination accuracy requirement. The IAS is expected to provided a minimum of first one year of time coefficients to the LPS.

3.2.2 Mission Phase

This interface communication is supported in all phases of the Landsat 7 mission.

3.2.3 Format

The format (Parameter name, data type, range, precision, and unit of measures) of the IAS calibration parameters file is specified in Applicable Document 2.1.1 (Landsat 7 Calibration Parameters File - Definition and Formats).

3.2.4 Accuracy/Completeness

The IAS shall always provide a complete set of IAS calibration parameters (including those defined in Section 3.2.1 and others as selected by IAS) in a single file. In particular, the new IAS calibration parameters file shall include both values that have been revised and values that are unchanged since the last delivered file.

3.2.5 Data Transfer

IAS personnel shall inform (via voice or a hardcopy message) LPS operations about the availability of an IAS calibration parameters file at least 7 working days before the IAS_PARAMETERS_EFFECTIVE_DATE specified in the file. (This assessment is based on allowing 1 day for LPS to retrieve, prepare and test the new IAS calibration parameters file, 3 days for IAS to resolve unexpected problems (if any), 2 day for IAS to coordinate an operational effective date/time with LP DAAC and LPS operations and 1 day to perform the switchover.) IAS personnel shall provide complete information to LPS personnel on the location of the IAS calibration parameters file in IAS for accessing and transferring it using the FTP procedures.

LPS personnel shall use FTP (internet) procedures to receive the IAS calibration parameters file at the LPS back-up/test string console. LPS personnel shall conduct initial checkout of the IAS calibration parameters file using the LPS configured test data set and/or the live raw wideband data received from the Landsat 7 spacecraft (LPS and LGS personnel coordinate the LGS matrix switch connection). LPS personnel shall evaluate the level 0R test data files/results generated during the checkout to determine the usability of the new IAS calibration parameters file in LPS. If problems are encountered in successfully using the IAS calibration parameters file on the LPS back-up/test string, LPS personnel shall inform/request IAS personnel to provide a corrected parameter file.

LPS personnel shall inform IAS personnel when the IAS calibration parameters file is successfully checked-out using the LPS back-up/test string. IAS personnel shall coordinate the switchover to the new IAS calibration parameters file with the LP DAAC and determine an effective date/time for using the new file in LPS operations. LPS personnel shall use FTP procedures to transfer the new IAS calibration parameters file from the LPS back-up/test console to the LPS operations console connected to the four operational strings. Each LPS string receives its own copy of the new IAS calibration parameters file (already verified at the LPS back-up/test string) from the LPS operations console for using in its Level 0R processing operations.

3.2.6 Delivery Schedule

During mission readiness testing and in-orbit testing, the IAS shall provide new IAS calibration parameters files at any rate necessary to support testing. During normal operations, the IAS will normally provide a new IAS calibration parameters file every three months. The IAS shall provide a new IAS calibration parameters file at most one year after delivery of the previous file and at least three months after delivery of the previous file.

3.2.7 Timespan

The new version of the IAS calibration parameters are valid for operational testing by the LPS immediately upon receipt from IAS. A 7 day evaluation period allows IAS and LPS personnel sufficient time to verify the usability of the new IAS calibration parameters file prior to its use in LPS Level 0R processing operations. The LPS shall use the new IAS calibration parameters, when successfully verified and concurred by IAS (via operational procedure at EDC) for a switchover.

The existing version of the IAS calibration parameters (file) are valid for operational use by LPS until the new version of the IAS calibration parameters are verified and coordinated by IAS for use in the Landsat 7 operations (LPS, IAS and LP DAAC). A nominal timespan of 3 month is expected for each version of the IAS calibration parameters.

3.2.8 Transmission Medium (TBR)

3.2.8.1 Description

The IAS calibration parameters file shall be transmitted from the IAS to the LPS via an EDC supplied Ethernet LAN to which both the IAS and LPS hosts or consoles are connected.

3.2.8.2 Prime Medium

The prime transmission medium for IAS calibration parameters file transfer is the EDC LAN. Table 3-3 provides specific details on the transmission medium used in the electronic transfer of the IAS calibration parameters file.

3.2.8.3 Backup Medium

No back-up and/or physical media is provided for transferring the IAS calibration parameters file to LPS when the EDC LAN is down.

3.2.9 Volume Estimate

The IAS calibration parameters file is expected to be as large as 1.0 megabyte (**TBR**). (This volume includes a 100% overhead to the estimate provided by the IAS Project).

3.2.10 Security Exceptions

The interface shall conform to EDC security standards in all cases.

Table 3-2: IAS Calibration Parameters File Transmission - Prime Medium

LPS Host Names	**LPS TBD**
LPS IP Addresses	**LPS TBD**
LPS Port Number	25 (smtp)
EDC Routers	**EDC TBD**
Network/Protocols	Simple Mail Transport Protocol (SMTP), Transport Control Protocol (TCP), Internet Protocol (IP) - (includes FTP) Ethernet 802.3 Data Link Protocol, **TBD** wire Ethernet (at EDC)
File organization	SMTP mail header followed immediately by IAS calibration parameters file.
IAS Host Names	**IAS TBD**
IAS IP Addresses	**IAS TBD**
IAS Port Number	25 (smtp)

3.3 Reprocessing Request

3.3.1 Description

A reprocessing request notifies the LPS that level 0R processing is to be performed again on a specified Landsat 7 contact period's data.

3.3.2 Mission Phase

The communication of this request is supported in all phases of the Landsat 7 mission.

3.3.3 Format

IAS personnel shall include the following information, available from the LPS metadata file (Applicable Document 2.2.2), in a reprocessing request for the Level 0R data subinterval requiring reprocessing by LPS:

a. Subinterval start and stop times (from LPS metadata file)

b. Metadata file name associated with the subinterval requiring reprocessing by LPS

c. Landsat 7 contact period information (start and stop date and times from the LPS metadata file)

d. Landsat 7 X-band frequency identification associated with the contact period/subinterval requiring reprocessing (from LPS metadata file name)

e. LPS hardware string identification (from the LPS metadata file)

f. Level 0R file version number (from the LPS metadata file)

LPS personnel use the subinterval information provided in the IAS request to determine tape labels and to retrieve the two raw wideband data tapes from the 30-day storage for Level 0R reprocessing. These two tapes contain the raw wideband data from the I and Q channels of the X-band frequency identification of the contact period/subinterval requiring reprocessing by the LPS. LPS reprocesses the entire contact period stored on the two I and Q channel raw data tapes to fulfill the IAS reprocessing request.

3.3.4 Accuracy/Completeness

IAS personnel shall provide all information (as specified in Section 3.3.3) identifying the Landsat 7 contact period to be reprocessed by the LPS.

3.3.5 Data Transfer

IAS personnel shall submit reprocessing requests via voice and/or paper to LPS operations. Specific procedures for submitting, receiving, logging and servicing these reprocessing requests will be defined by EDC **(TBR).**

3.3.6 Delivery Schedule

The IAS is expected to request reprocessing at an average rate of 1 request per day (based on an expected reprocessing volume of 10% of all Landsat 7 data

captured and six daily contact periods). The LPS can service at most 1 reprocessing requests per day from IAS.

3.3.7 Timespan

A reprocessing request submitted by IAS to LPS shall be valid until a disposition message is provided by LPS to IAS.

3.3.8 Transmission Medium

3.3.8.1 Description

Reprocessing requests are operator-to-operator transmissions via Voice or Paper.

3.3.8.2 Prime Medium

The prime medium is the EDC telephone system. The IAS operator shall contact/dial the LPS operator/telephone number to request reprocessing.

3.3.8.3 Backup Medium

A written reprocessing request containing the information specified in section 3.3.3 is the back-up transmission medium. Written requests shall be delivered to the LPS operator in accordance with existing Landsat 7 operations procedures at EDC.

3.3.9 Volume Estimate

Not Applicable (voice/paper requests)

3.3.10 Security Exceptions

There are no security exceptions for this interface.

3.4 Reprocessing Request Disposition

3.4.1 Description

A reprocessing request disposition informs IAS personnel of whether a reprocessing request has been included in the LPS production schedule or it cannot be honored.

3.4.2 Mission Phase

The communication of this product is supported in all phases of the Landsat 7 mission.

3.4.3 Format

LPS personnel shall include/use information provided in the IAS reprocessing request (see section 3.3.3) for composing the reprocessing request disposition message. LPS personnel shall further state the disposition of the reprocessing request by including one of the following status:

a. The date and time the IAS request has been scheduled for reprocessing by LPS.

b. The reprocessing request cannot be honored because the raw data to be reprocessed is not available in the 30 day storage.

c. The request cannot be honored in a timely fashion (within two weeks).

3.4.4 Accuracy/Completeness

LPS personnel shall always provide all information identifying the IAS reprocessing request, the Landsat 7 contact period to be reprocessed and the disposition status.

3.4.5 Data Transfer

LPS personnel shall inform IAS personnel regarding the disposition their reprocessing requests via voice and/or paper. Specific procedures for providing, receiving and logging reprocessing request dispositions will be defined by EDC **(TBR).**

3.4.6 Delivery Schedule

LPS personnel shall provide a disposition within one hour of the receipt of the reprocessing request by LPS operations. LPS personnel shall provide an updated disposition to IAS personnel when the requested Level 0R reprocessing is complete or if unexpected problems are encountered during Level 0R reprocessing.

3.4.7 Timespan

Not Applicable

3.4.8 Transmission Medium

3.4.8.1 Description

Reprocessing request dispositions are provided via operator-to-operator communication using voice/telephone and/or paper.

3.4.8.2 Prime Medium

The prime medium is the EDC telephone system. The LPS operator contacts/dials the IAS operator/console telephone number to deliver the reprocessing request disposition.

3.4.8.3 Backup Medium

A written reprocessing request disposition containing information specified in section 3.4.3 is the back-up transmission medium. The written dispositions shall be delivered to IAS personnel in accordance with the Landsat 7 operations procedure in force at EDC **(TBR).**

3.4.9 Volume Estimate

Not Applicable (voice/paper requests)

3.4.10 Security Exceptions

There are no security exceptions for this interface.

Abbreviations And Acronyms

IAS	Image Assessment System
ICD	Interface Control Document
DCN	Document Change Notice
EDC	EROS Data Center
EROS	Earth Resources Observation System
ETM+	Enhanced Thematic Mapper plus
F&PS	Functional and Performance Specification
GHA	Greenwich Hour Angle
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
IP	Internet Protocol
LAN	Local Area Network
LP DAAC	Land Processes Distributed Active Archive Center
LPS	Landsat 7 Processing System
Mbps	megabits per second
MO&DSD	Mission Operations and Data Systems Directorate
SMTP	Simple Mail Transport Protocol
TBD	To Be Defined/Determined
TBR	To Be Reviewed/Resolved
TBS	To Be Supplied
TCP	Transport Control Protocol